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PREFACE.

In the summer of 1911, when the Prime Ministers of the Self-governing Dominions were present in England, they were invited by the Secretary of State for the Colonies to discuss with the Entomological Research Committee (appointed by the Colonial Office in 1909) certain proposals for furthering and co-ordinating the investigation of injurious insects throughout the Empire. At this meeting it was unanimously agreed that the establishment of a central organisation for this purpose was desirable, and consequently a tentative scheme was submitted for the consideration of the Colonial Governments concerned.

At a further conference, held at the Colonial Office in August 1912, the matter took more definite shape, and it was proposed to form an Imperial Bureau of Entomology, to be supported by contributions from the various Dominions and Colonies, as well as from the British Government. The principal functions of this Bureau will be to collect and co-ordinate all information bearing upon injurious or useful insects; to organise a system for securing the authoritative identification, with reasonable promptitude, of all insects of economic importance submitted by officials connected with Departments of Agriculture or Public Health throughout the Empire; to compile gradually a comprehensive card-index to the whole literature of the subject; and to publish monthly the present journal, which is intended to give an up-to-date epitome of the current literature.

The Bureau is fortunate in having secured as its President so eminent an administrator as the Earl of Cromer, and the names of the many distinguished gentlemen who have been good enough to act on the Honorary Committee of Management will be sufficient guarantee that its work will be carried out in an efficient and sympathetic manner.

It is not perhaps generally realised how numerous or how varied are the existing publications which are liable to contain entomological information. A preliminary survey of the subject has resulted in the compilation of a list (by no means complete) of no less than 1,700 periodicals,—scientific, agricultural and medical,—which may contain articles dealing with entomology. And even if it should prove that nearly one-half these journals will never contain any matter to which reference need be made in the pages of this Review, yet the material that remains is still sufficiently formidable. Furthermore, the number of periodicals expressly dealing with Economic Entomology is steadily growing from year to year; and this is due not only to a more general recognition of the high importance of this subject both in its

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agricultural and medical aspects, but also to the greater activity in the development of tropical areas, where the depredations of insects are most severely felt.

It may be said with some degree of certainty that there is at present no single institution in the world at which all these multifarious journals may be consulted, and it is hardly necessary to insist that if the individual workers in the Empire, who are concerned with Economic Entomology in one or other of its various aspects, are to be kept adequately informed as to the observations and discoveries that are being made elsewhere, some centralised system for the publication of a compact yet comprehensive survey of the subject is in the highest degree desirable.

The perfection of such an organisation must needs take time; nor can its ultimate success be assured by the efforts of the Committee of the Imperial Bureau of Entomology alone. This is essentially a matter for co-operation. It is therefore to be hoped that all persons in the Colonies who are interested in the practical application of Entomology to agriculture or medicine will endeavour to see that the Bureau shall be promptly supplied with all local publications bearing on these subjects, and also be advised of any new observations that may be made, in order that such information may be rendered accessible to workers in other parts of the Empire with the least possible delay.

From one of the Dominions comes the useful suggestion that the Government Entomologist in each contributing Colony should send every month, for publication in this Review, a brief statement (never to exceed 300 words) giving a concise summary of the outstanding features of his current work. There can be little question that such a general survey would prove both interesting and useful, but it is obvious that its accomplishment must rest in the hands of the official entomologists concerned. It is sincerely to be hoped that it may be found feasible to carry the proposal into effect.

While the principal object of this Review is to afford such assistance as may be possible to those whose business it is to combat injurious insects in the interests of humanity, yet it is confidently anticipated that its pages will prove useful to a still wider public. To entomologists in general it should be a matter of congratulation that their favourite study, whose importance is now at last receiving a somewhat tardy recognition, should be made the subject of so valuable and instructive an experiment in Imperial co-operation; an experiment which has only been rendered possible by the generous financial support accorded by every British Colony.

THE EDITOR.

SEAVER (F. J.). **The Leopard Moth** (*Zeuzera* sp.).—*Jl. N. York Bot. Garden.* XIII. No. 154. Oct., 1912. pp. 155-160.

This destructive pest was introduced into the United States from Europe. It was reported in Brooklyn about twenty years ago, and is now thoroughly established in the east. In the New York Botanical Garden the trees most commonly attacked are the maples, especially the silver maple and the sugar maple. Ash trees, box, elder, basswood, and pin oak are also attacked. A few larvae have been obtained from cultivated shrubs, *Spiraea sp.* and *Viburnum opulus*. It is said to attack the elm and the tulip tree, but no evidence in support of this has been obtained in the Garden.

The damage is caused by the larvae boring in the wood of the branches or stem of the trees attacked. The attempts on the part of the tree to heal the wound result in the formation of large unsightly scars. The attack can be detected in its early stages by the presence on the ground of the partly digested wood thrown out of the burrows excavated by the larvae. When the burrow is sufficiently large the opening is closed by a whitish, semi-transparent, web-like membrane.

The larvae actually in the tree may be killed either by injecting a poison, such as carbon bisulphide, into the burrow and stopping up the hole with putty, or by removing the larvae with a wire provided with a hook or barb at the end. The latter method is the better. Smaller infested branches on old trees should be removed and destroyed, and small trees which are badly infested in the main stem should be replaced by healthy specimens. Local inspection of trees and destruction of larvae should yield beneficial results.

Mededeelingen van het Proefstation Midden-Java. No. 4. 1911-12. pp. 17-23.

The cacao moth, *Acrocercops* (*Zaratha cramerella*, Sn., is prevalent over the whole of Java. Careful observations are being made by Dr. Roepke, Director of the Experiment Station (Salatiga), on the life-history of the species and on the action of various insecticides; the resistant qualities of the different varieties of cacao are also being investigated. He is of opinion that there are three species of ICHNEUMONIDAE which may prove to be really useful parasites of the moth. The *Helopeltis* bug (CAPSIDAE) has done much damage. The hybrid cacao known as Djati Roenggo is being cultivated, as being more resistant to the pest, and the black cacao ant is being introduced into the plantations, in some cases with success. The "white louse" (witte luizen) and the black ants are being studied in the laboratory and the following enemies of the "white louse" have been discovered: (1) a small species of Chalcid; (2) the caterpillar of a Lycaenid butterfly, *Spalgis epius*, Westw.; and (3) a small species of fly related to *Diplosia*.

Cacao borers continue to be troublesome in the Selokaton district. Much still remains to be done for their thorough investigation. On one estate the Longicorn beetle, *Glenea sp.*,

appeared to predominate, whilst on a neighbouring one the pest was another Longicorn, *Pelargoderus sp.* The persistent collection of the beetles kept them within bounds on one estate. In the badly attacked gardens small heaps of cuttings of Ficus and cacao were being used as traps and it was expected that *Pelargoderus* would breed in them; proof of this is awaited with interest.

The cacao weevil, *Alcides sp.*,* is common all over the district of Randoe. The Director saw in East Java long stretches of country in which this pest rendered cultivation almost impossible. In the month of June about a hundred specimens of cacao were received from a plantation in Salatiga, all of which had been attacked by the *Alcides*. The insects had all been removed, to prevent further spread of the pest.

The "ring-borer" is sporadic and only found on some plantations. Dr. Roepke suggests as a remedy the stopping of the holes with small wooden plugs smeared with fluid tar; this kills the borer and does no harm to the tree, and, further, it can be carried out before the damage has gone far.

Material was constantly received showing damage by a boring caterpillar which lives on the ripe and unripe cacao pods. Pupation takes place in strong cocoons, built up of excrement spun together and fastened either to the pod itself or close to it; the cocoon exhibits on one side a peculiar prolongation resembling the neck of a retort. The imago is a small Noctuid moth, not yet determined. It is not uncommon to find 10-20 of these caterpillars in one pod; but at present the insect causes no damage worth mentioning, as the attack is always confined to individual pods.

The *Zeuzera* borer (COSSIDAE) is nowhere numerous; parasites of this moth have been found.

In the months of April and May quantities of small beetles of the family HALTICIDAE were sent in from Semarang as causing damage to cacao plants. They have no metallic lustre and are more like red-brown ladybirds, but differ from them in that they have a remarkable power of jumping. They eat a number of holes in the youngest leaves and do not touch the older ones. If the attack be severe the whole seedling dies off. This beetle was not known until recently and has not been determined. It has been kept for many weeks in captivity without laying any eggs, so that its mode of development is still unknown.

"Slug caterpillars" belonging to various species of LIMACODIDAE are not infrequent on cacao, as well as on other crops, but generally they disappear without doing any serious damage. These larvae have been received at the Station as damaging cacao in the Ambarawa district and include two different species of the genus *Belippa*, which, because of their resemblance to the pith of the "Arènpalm" (*Arenga saccharifera*), are called by the natives "oelar kolangkaleng."

* [*Alcides leeuweni*, Heller (Deut. Ent. Zeit. 1911, p. 312), the life-history of which has been recorded by Dr. van Leeuwen (Deut. Ent. Zeit. 1910, p. 268).—ED.]

This pest is not of much importance, as it is already being kept down by collecting the caterpillars systematically.

Ants' nests, hanging to the trees on a plantation at Salatiga, were found to be constructed of the leaves of young bamboo shoots and to be infested by an as yet undetermined species of rat, presumably in search of these shoots (sloembring) which might possibly be used in other places as bait for the rats.

The Scolytid beetle, *Xyleborus coffeae*, the native name of which is "boeboek," is local and some plantations are entirely free from it; but even in the areas which may be called its home it has given no great cause for anxiety. It appears that a small Ichneumonid (sluipwespje) or Braconid holds the pest in check. Instructions were given to attempt to catch this coffee borer (*Coffea robusta* is named throughout as the species of coffee attacked and the insect is referred to as the "robusta-boeboek") by means of lanterns; but the experiments failed signally, not a single *Xyleborus* being taken. Other bark-beetles came to the light which had enough resemblance to *Xyleborus* to be possible sources of error. It would appear to be the view of the authorities that if the plantations of *C. robusta* are well looked after, all damaged branches lopped and decaying trees felled, the "boeboek" pest is not much to be feared.

Caterpillars on the flowers of *C. robusta* occur everywhere. The damage is sometimes insignificant, but occasionally very considerable. The species implicated belong to the families Tineidae, Tortricidae, Noctuidae and Geometridae, the larvae often destroying the berries as well as the flowers; but it is very difficult to ascertain which species does the serious damage. Dr. Roepke is of opinion that most *C. robusta* trees, though not all, which are infested with the "white louse" and ants are specially liable to this caterpillar attack and that the thorough cleaning of the trees from these will mitigate the pest. Tobacco or soap sprays will probably prove effective remedies.

Dewitz (Dr. J.). **Bearbeitung der Literatur der Traubenwickler** (Review of the literature of the vine moths) **Nr. 2.**—*Bericht der Königl. Lehranstalt fur Wein, Obst und Gartenbau zu Geisenheim a. Rh. für das Etatsjahr*, 1911. (Berlin, P. Parey, 1912.) pp. 218-277.

General Bionomics of Clysia (Conchylis) ambiguella *and* Polychrosis botrana.

It is obviously a matter of importance to make careful observations of the exact date of appearance of the moths in each year. This date is very largely a question of temperature, and will consequently vary with the locality and the season. The moths lay their eggs on the buds, and it has been found useful to set up lamps for catching them as soon as the latter appear, about 10 lamps being used to the hectare (rather more than 4 to the acre). Another plan is to breed out pupae in the open near the vineyards and time the operations according to the date of appearance of the imago. An infested vine enclosed in a muslin

net has been found a simple and effective means of making these observations. This method though useful in the case of *Clysia* (*Conchylis*) *ambiguella* cannot be relied upon for *Polychrosis botrana* which is not easily taken with the lamps, and systematic "drives," in the direction of the wind, of definite areas in the vineyard are recommended. In some of the wine-growing districts of France "warning stations" (stations d'avertissement) have been in operation since 1904. Observations made in Germany between 1856 and 1890 give May 17th as the mean date of attack, May 1st (1869) as the earliest and June 1st (1879) as the latest date of appearance of the pest. It is more or less determined that the moth appears in the Gironde 8 days later, and in the neighbourhood of Saumur, Anjou, Paris and Champagne 14 days later than on the Mediterranean.

The life period of the first generation varies with temperature and general weather conditions and therefore with the district. In the Gironde, in normal years, 8 days seem to be the average. *Polychrosis botrana* is found on the wing about dawn and again in the twilight. *C. ambiguella* attaches itself during the day to the underside of the leaves or on the shady side of posts, etc., and begins to fly about two hours before sundown, continuing till midnight and, in warm weather, the whole night long. One observer in the Moselle district says that in fine warm weather, and even when cloudy and a fine rain is falling, about 9 a.m., and again from 6 p.m. onwards, the moths flutter round the vine-stocks and that at these times more may be caught with the racquet in a few minutes than in an ordinary half day.

They appear to be carried great distances in windy weather and on the whole to be more abundant on the edges of vineyards near to field-roads and ditches than in the centre. This is probably due to their tendency to fly towards the light.

They also seem to frequent by preference vineyards in which the leaves are abundant and well developed—as they there find shelter from the sun and heat. It has been observed that when the temperature is continuously high the moths of the second generation disappear suddenly. Experiments have shown that a temperature of 35° C. (95° F.) is fatal to them.

The moths (*C. ambiguella*) begin to move about 3 to 4 days after emergence and then copulation takes place; the eggs are laid about 8 days later and the whole life of the female has been computed at not more 3 weeks. The same appears to hold good of *Polychrosis botrana*. The eggs are generally laid before sundown. Estimates of the number of eggs laid by each female vary. The ovaries contain usually 150-200 and the number actually laid is possibly 120-130. In the second generation the number of ovarian eggs diminishes greatly, falling to 30 or less, and the number actually laid is proportionally smaller.

The first generation oviposits on the flower-buds and flower-stalks, the second on the fruit and fruit-stalks, and the third generation appears to seek the berries which have been already damaged by the previous brood. There is some evidence that in choosing a place for her eggs, the female of *Polychrosis* endeavours to seek a smooth surface. Bunches of grapes which

had been experimentally covered with a powder or a sticky substance were found to be avoided; further, grapes exposed to the sun were much less attacked than those in shade. One observer fitted paper hoods to more than 300 bunches, leaving them open below and found three times as many caterpillars in the shaded than in the unshaded bunches. According to some authorities the female of the first generation of *Polychrosis* exercises considerable choice as to the variety of grape on which to deposit her eggs and tends to select the early flowering ones. A difference of 10 days in the flowering time of two sets of vine-stocks resulted in the early-flowering ones being covered with caterpillars and the late-flowering ones being free.

The eggs of *C. ambiguella* have been found on the following wild plants:—*Euonymus europaea, Viburnum opulus,* and on *Cornus mas.*

Periods of intense heat seem to be fatal to the eggs of both *C. ambiguella* and *P. botrana.* This was observed to be the case in the hot summer of 1911, during two very hot weeks in September 1906, and during the prevalence of a very hot wind in August 1892. Experiments show that a temperature of 40°-45° C. (104°-113° F.) destroys the vitality of the eggs of *P. botrana.* Continued bad weather appears to have a double effect; it not only interferes with the actual deposition of the eggs, but the eggs when laid largely fail to develop, due it is believed to changes which take place owing to detention in the oviducts.

The practical result of these observations is to favour the method of cultivation which permits the greatest exposure of the grapes to the sun and weather.

Destruction of the moths with sticky racquets.

These racquets (Klebfächer; racquettes engluées) are made of perforated metal or wire gauze smeared with some sticky substance; a mixture of 25 parts resin and 126 parts linseed oil, boiled together, is found satisfactory. It is essential that the material should remain sticky when in use and not become covered with a hard film. The racquets are 25 × 30 cm. (10″ × 12″), the upper edge being bent over to a half cylinder. The handle is about 18″ long with a cleft at one end in which the sheet of metal can be gripped. The sticky racquet is held in the right hand and the vines beaten with a stick held in the left; the moths fly out and are swept up with the racquet. When it becomes foul, or ceases to be effective, the metal plate is held over a fire and the oil and dead moths burned off. The cost of the appliance is very small and the results of its use are excellent. As many as 300 moths may often be caught in an hour by one boy. In the Gironde *P. botrana* is kept down by this means, but instead of one, two racquets are used, one in each hand. The operation must be very thoroughly carried out and as many persons as possible employed at once, and if the vineyard be not isolated it should be repeated several times. Opinions differ, but on the whole the late afternoon and evening appear to be the best times for the work, and also the very early morning just

before and after dawn. Dull cloudy days are best. The figures from a vineyard of about 22 hectares (50 acres) for the years 1901-1905, both inclusive, are as follows:—For the two generations combined, thousands caught, 306, 190, 49, 38, 25, the ratio of first and second generations being approximately 1 : 2; in addition, the captures by lamps at night were for the respective years 72, 19, 15, 8, 2, making a grand total of 726,462 moths captured. The total cost for the 5 years was 38,145 marks and the net extra profit obtained was reckoned at 289,449 marks.

The results obtained by G. Farini near Padua are quoted for the 10 years 1890-99. In 1892 he captured 14,000 moths of the first generation between 26th April and 21st May, and 2,417 of the second generation between 28th June and 12th July. In 1893 17,000 and 1,500 respectively. In 1894 24,600 and 1,500. In the years 1897-8-9 the figures for the first generation were 26,160, 11,269 and 23,278. These results were considered good and the damage done was small. In another vineyard 18 workpeople in 27 days captured 20,230 moths, an average of 41 moths per head per diem. Cloths smeared with some sticky substance and stretched between the rows of vines have not proved successful, and the use of insecticides mixed with treacle or sugar and sprayed on to the vines more or less failed because of the difficulty of preparing a solution which is not liable to dry up or be washed off by rain.

Use of lamps and lights of various kinds.

The attraction of various monochromatic lights for the moths has been investigated by Perraud (Pr. agr. vit. I, 1904, pp. 722-23). He found that white lights attracted 33·3 per cent., yellow 21·3 per cent., green 13·8 per cent., orange 13 per cent., red 11·5 per cent., blue 3·9 per cent., violet 2·2 per cent. Other investigators have found a green light decidedly the most attractive. It appears also to be fairly well established that a diffused light is more attractive than a naked one, and that a very intense light is by no means so attractive as a somewhat feeble one, *e.g.*, oil, petroleum and even candle lanterns appear to be more effective than acetylene lamps, and on the whole petroleum lamps are the best. In the German vineyards the following form of lamp is largely used. A large drinking glass is half-filled with good oil and a floating wick arranged with a piece of cork and 3 pins stuck into it so that the wick shall not touch the sides of the glass. The upper part of the glass is wrapped round with paper smeared with some sticky substance.

The necessity for the constant renewal of this latter causes a serious amount of labour and consequently the lamp is often set in a shallow tray of water.

Acetylene lamps have been extensively tried in France and prizes offered for the most effective and cheapest, not costing more than 10 centimes per lamp per night. The price of such lamps worked out at 6·25 fcs. to 7 fcs. each, which renders their use impracticable, at least in the South of France, where 10 lamps to the hectare is the usual number, so that lamps for an area of 500 hectares (1,125 acres) would cost about £1,300 sterling.

Experiments have been made in wiring vineyards so that small 5 c.p. lamps fitted with a sticky paper shade could be arranged at regular intervals and at any desired height above the ground. The proper height is not easily determined, but 70 cm. (28″) appears to have yielded the best results. The radius of action of lights has been investigated and it has been found that while *C. ambiguella* was attracted at a distance of 25 m. (28 yds.), *P. botrana* was not; and generally speaking it would appear that the latter is not so much attracted by light as the former, though some observers have captured large numbers of *P. botrana* in this way. The methods adopted in the different cases are perhaps not strictly comparable. An essential condition for success with either species is that the night should be warm, quiet and dark. During periods of drought the moths are more difficult of capture. Moonlight and gusty weather tend greatly to prevent capture by lamps.

Experiments with lamps in a vineyard on the Moselle, 2-7 Aug. 1899, 5 nights with an average of 161 lamps per night, resulted in the capture of 18,639 moths, or an average of 23·1 moths per lamp and night. There was on an average one lamp to every 600 vinestocks, much too small a number for the tall and large vines of the district. The lamps should not be more than 14-16 m. apart. In the same vineyards, from 24th July to 3rd Aug. 1900, 54,591 moths were caught with lamps at a cost of 2,612 marks (£130), *i.e.*, the capture of each 21 moths by this method cost about one shilling.

Careful observations have been made by David and Laborde at La Maqueline in the Gironde in the years 1898-1901. In 1900, 80,000 moths of the second brood were caught on 120 hectares (270 acres), and it was hoped that there were none remaining, but in August, a very short time after the operations, an average of 5-10 caterpillars per vine-stock was collected, *i.e.*, 1,200,000 in the whole vineyard. In 1901 the same vineyard was fitted with 1,200 lanterns, with the result that from 7th to 24th July (second brood) 100,000 moths were taken, of which about 60 per cent. were males and 40 per cent. females. Of the females only 1 in 5 were believed not to have laid any eggs. It was computed that 496,000 possible caterpillars were thus prevented from developing. The total cost was 1,600 fcs. (£64).

In Verzenay on 6 hectares (13½ acres) with 117 electric lamps (5 c.p.), between 4th July and 4th August 1910, 20,915 *C. ambiguella* and 251,270 *Sparganothis* (*Oenophthira*) *pilleriana* were taken.

Use of baits.

It has been observed that in those parts of vineyards which have been used for the deposit of dung, more moths are to be found than elsewhere. Dewitz (Zeit. Wiss. Insektenbiol. I, 1905, pp. 193-99, 237-47, 281-85, and 338-47) has determined that the odour of the nectaries of the vine flowers attracts the moths and invites them to lay their eggs on the buds.

This habit of the moths has been largely made use of for their destruction with considerable success. Various mixtures

have been tried, cider, beer, vinegar, wine made from the grape waste (Trester-wein), beer mixed with sugar, sugar solution flavoured with fruit ethers or extracts of aromatic plants, vinegar and sugar, and many others. Apple pulp in water, to which a few drops of fruit ethers were added, has yielded excellent results in the Pfalz, 20,000-40,000 moths being captured in some vineyards in 24 hours with a large number of glass flytraps baited with this mixture.

Labergerie (Revue de Viticulture, xxxvi, 1911, pp. 612-614), using only molasses diluted with water exposed in 3,000 earthenware and 200 tin vessels, captured about 60,000 *Clysia* (*Conchylis*), 30,000 *Polychrosis* and more than 200,000 caterpillars of *Sparganothis* (*Oenophthira*) between 15th May and 15th September, 1911.

The results of the method of capture by bait lead to the following conclusions. The various wine mixtures are the best and the addition of fruit ethers is unnecessary. The commencement of fermentation renders the liquid more attractive. The neighbourhood of certain plants, such as, Ampelopsis, ivy, currants, gooseberries and other strong-smelling plants, should be avoided in setting the traps. White dishes appear to be more attractive than red or other earthenware. Metal dishes are to be avoided. The traps should be set in the shade. The second brood is the one most readily caught by this method. The warmer weather prevailing at the time of their appearance has possibly a considerable effect on the results; the odour is more readily distributed, the moths are more active and it is the season observed by collectors to be the best for catching by baits.

As it is more or less well established that the moths avoid various strong odours, attempts have been made to keep them away by the use of "Rubina" a preparation of wood-tar and caustic soda, much used in Italy as an insecticide. Chloroform, sulphuretted hydrogen, nitrobenzol, tar, essence of orange flowers, peppermint, eucalyptus, rosemary, cinnamon, geranium, melissa and even asafoetida have been tried. Capus and Flytaud (Revue de Viticulture, xxxiii, pp. 231-37) sprayed with solutions of nicotine and of barium chloride and found that in both cases the number of eggs laid on the sprayed vines was much less than on the unsprayed. Bordeaux mixture was found to have a similar effect.

The reports of different observers as to the relative proportion of male and female moths captured by the various methods, show little or no consistency, and the possibility of serious error in dealing with large numbers of moths must not be overlooked. It seems to be more or less definitely established that on warm quiet nights more females than males may be captured by either the racquet or lamp method and *vice versâ* on cold or windy nights. The traps also seem to yield more males than females, but the proportion varies with the local conditions.

A very full bibliography of the subject accompanies the report.

Morstatt (H.), Amani, German E. Africa. **Pests of Camphor Trees.**—*Der Pflanzer*, VIII. 1 Jan. 1912. pp. 16-24.

The author states that all camphor tree pests known to date in the Colony are indigenous and have migrated from their native food plants to the camphor.

Stinking Grasshopper.—*Zonocerus elegans*, Thb., is found on the young trees as a rule only when the weeds and other natural food-plants are either consumed or dried up. It eats only the youngest yellow shoots and is very irregular in its appearance as a pest.

Weevils.—*Dicasticus gerstaeckeri*, Faust, is plentiful on many wild and cultivated plants, but irregular in its appearance as a pest: *e.g.*, plentiful on camphor trees in Amani in 1910, all but absent in 1911. Eats only the young shoots and the edges of very young leaves. Easily shaken off the trees and collected. The author kept two of the weevils alive for 18 months on a diet of camphor shoots only. *Systates irregularis*, Fst., plentiful on other plants and occasionally visits camphor.

Camphor Borer.—*Tragocephala pretiosa*, Hintz, behaves in much the same way as the yellow coffee borer. The female gnaws a series of holes in the bark of a twig, often ringing it completely, and deposits her eggs in them. The larvae first attack the outer end of the twig or branch, but soon turn about and bore in the opposite direction. The young twigs drop off and branches are frequently destroyed. The tunnels often break through the bark. The total life cycle appears to be two years. An affected branch cut in Wilhelmstal in March contained the perfect insect in November. The twigs drop off in the hot weather at the beginning of the year and large larvae can be found in the branches, in August the pupae, and in November the perfect insect. The pest is fortunately easily combated. In January and February the attacked twigs are sawn or cut off an inch or two below the bored spot and burned, and as at this period the larvae have not had time to bore far, their capture and destruction is assured. In Amani, the year following this treatment, the pest had practically disappeared.

Bugs.—From September, 1907, to February, 1908, the young camphor trees at Amani exhibited serious injury to the twigs and dry tips which agreed with the attack of the cinchona bug. They have been traced from the cinchonas to the camphor trees. They suck only the growing points and leaf buds, so that the former are killed and consequently the twigs remain short and numerous new buds are formed so that an abnormal bushy condition of growth results. The damage rarely extends to trees grown with a single stem, especially if they are of some age.

Scale Insects.—*Aspidiotus destructor*, Sign., the coconut palm scale is not uncommon on the under side of the leaves of the camphor trees. Another species *Aspidiotus cyanophylli*, Sign., is also found on camphor, but neither species has as yet risen to the rank of a pest.

Moore (W.), Lecturer in Entomology, Sch. of Agric., Potchefstroom. **"The Pepper Tree Caterpillar"** (*Bombycomorpha bifascia*, Wlk.)—*Agric. Jl. of the Union of S. Africa.* IV. Oct. 1912. pp. 539-542.

This pest has for several years past stripped the "pepper trees" grown for shade at Klerksdorp, Transvaal. The eggs of the first brood are laid about the beginning of October in a band about one inch in length around the petiole of the leaf or on a young twig. They hatch in about 20-25 days and the caterpillars are generally gregarious. They feed at night, congregating round a small limb in the daytime, and reach maturity in about 40 days or near the middle of December. The cocoons are oval, made up of hair from the body and dirt, and are generally most abundant on the ground under the infested tree, though they are to be found on the limbs of the trees and elsewhere. Moths of the second brood appear about the end of February and the caterpillars from the eggs laid by them are found on the trees in April, being fully grown by the end of May and passing the winter as pupae.

The pest is widely distributed over the country and its work has been noticed in Pretoria, Warmbaths, and on a few trees in Potchefstroom. It is a native of South Africa and has been noticed on the Karee Boom, which is probably its native foodplant. This tree is common near the Vaal, which may account for the abundance of caterpillars at Klerksdorp.

About 25 per cent. of the caterpillars collected on December 12th were parasitised by a Tachinid fly. As the caterpillars were protected for a week before pupation the percentage would probably be higher in the natural state. Unfortunately the period of oviposition of this fly does not correspond with the appearance of the various broods of caterpillars sufficiently to be of much real service. The fly also often lays its eggs on the caterpillar just before a moult and the latter consequently escapes.

Remedies.—Collect as many cocoons under the trees as possible and spray the leaves with 2 lb. lead arsenate to 100 gals. water during April and May.

Fuller (Claude), Government Entomologist, Natal. **White Ants in Natal.**—*Agric. Jl. of the Union of S. Africa.* IV. Oct., 1912. pp. 542-571.

Attack on Houses.—As the result of much careful observation the writer lays stress on the importance of raising houses 2 or 3 feet above the ground and admitting all the light and air possible to this space between the soil and the floor-joists. Tiled floors should be laid on concrete beds supported by ironwork. Piers used as supports should not be "brick boxes filled with earth and the debris of building operations" but should be empty and have openings to allow light and air to enter freely. Jarrah piles may be used as this wood is not attacked, or, if the pillars are of brick or stone, these should be set in sand and cement. White ants cannot tolerate constant disturbance. They will eat up a deserted Kaffir hut and never approach an inhabited one.

Attack on fruit trees and plantations.—The Natal termites will not eat peach trees, and advantage has been taken of this to graft most plums on to peach stocks. Apricots, apples and pears are commonly attacked; citrus trees, anonas, bananas, avocados, mangos and loquats are to all intents and purposes exempt from attack. The termite attack on wattle plantations is serious. The best precaution is to clear the land of them thoroughly before planting. Damage is generally done in the first three years and 30 per cent. of the trees may be lost if no precautions be taken. After this period there is enough litter under the trees to satisfy the termites and they let the trees alone. When more or less under control fresh galleries or run-ways of the pest must be constantly sought for and traced by blowing smoke into them with a fume machine. The smoke enables the nest to be located and destroyed. These galleries have been known to extend 90 feet or more from the nest in the case of the "Natal termite."

Timber for building purposes, posts, etc., are best preserved by soaking for 2 or 3 days in a 10 per cent. solution of arsenite of soda in water or by creosoting. Charring the lower ends of posts is only of use when it is made to extend some distance above ground as well as below.

Mededeelingen van het Deli Proefstation. Jahrgang VII. Oct., 1912. pp. 129-146.

Imported Parasites.—The Director of the Station reports that satisfactory results have been obtained from the importation from the United States of the eggs of a Chalcidid, *Trichogramma pretiosa,* Riley, to serve as a control for *Chloridea (Heliothis) obsoleta,* F. The eggs were brought from the United States in cold storage, and only a very small percentage failed to hatch. As in the U.S.A., so in its new home, it has been found not to be exclusive in its tastes, the eggs of over a dozen different species of Lepidoptera having been attacked by it. This is a fact of the greatest importance, as if it confined its attention to one species and that species should fail or not be available for a considerable portion of the year, the parasite might die out from want of its peculiar host. This is not likely to be the case in Sumatra, for the authorities at Deli have found it infesting *Tiracola (Arcilasia) plagiata,* Wlk., *Ophiusa, Deiopeia* and *Remigia,* all well-known pests of local crops.

The number of flies produced from one egg was found to be very variable. Eggs of *Chloridea* and *Prodenia* yielded 1, 2 or 3, rarely 4; of *Remigia,* 6, 7, 8 and even 12.

It has further been discovered that *Trichogramma* parasitises various other Lepidoptera which feed on wild plants and which may possibly change their habit and invade the cultivated areas.

It is now established that *Trichogramma* in Deli has passed through 16 generations in the free state and that it has multiplied. At various dates between 18th Sept. 1911, and 12th Feb. 1912, numbers of laboratory-bred *Trichogramma* were released on the experimental plots at Serdangweg. At the end of July, eggs of *Ophiusa* and *Chloridea* were collected and yielded *Trichogramma,*

the laboratory period for a generation of which is 8-10 days. It is known that *Chloridea* prefers to lay its eggs upon the maize tassles and the following experiments were made:—

Three plots of flowering maize, (*a*) (*b*) (*c*), were taken and boxes, each containing several dozen *Trichogramma*, were distributed as follows:—One each on (*a*) and (*b*) and two on (*c*). Eggs of *Chloridea* were collected the next day from the maize tops as under:—(*a*) 13, of which none were infected; (*b*) 7, with 6 infected; and (*c*) 22, with 9 infected. An earlier experiment failed owing to drought. It is thus claimed that *Trichogramma* is capable of propagating itself in Sumatra and that its introduction will be of great practical utility.

Insecticides for Tobacco.—The use of Schweinfurt green in place of lead arsenate as an insecticide by tobacco planters, seems to be increasing. The Director of the Deli Expt. Station is of opinion that the difference in price is the cause and the unnecessary waste of the arsenate, which should be largely diluted with tapioca flour (or earth finely sifted). For use as an insecticide it has the great advantage over the Schweinfurt green that it does not damage the tobacco leaf. There is often great waste of material by planters, due to their not taking the weather conditions into proper account when applying insecticides. There is great need of some neutral substance to be used as a carrier for the insecticide which shall in itself be attractive to the pest. All manner of materials have been tried, but the caterpillars do not eat the treated leaves any more greedily than the untreated.

New pest of Tobacco.—A species of hawk-moth (*Acherontia*), new at least to the Deli tobacco growers, has made its appearance in Sumatra, and it seems probable that it resembles closely, if it be not identical with, one already reported from Java.

Imported Ladybirds.—The Aphis-eating Coccinellid, *Megilla maculata*, de G., imported from America, has been successfully reared and supplied to various tobacco plantations in small quantities. So far as these small experiments go it seems to have been useful; but it is not yet possible to say whether the insect has established itself or not.

Tenebrionid Beetles attacking Tobacco.—*Opatrum* and its larvae have done great damage in Sumatra during the year to the newly planted-out tobacco; the invasion extended over the whole East Coast from Upper Padang to Upper Langkat. The spreading of earth mixed with 10 per cent. naphthalin, or building lime, between the plants will do something to save them. A dressing of lime at the rate of 5 sacks per "veld" has been found to be useful. The beetles collect under stones, bits of wood and the like, and by setting traps of this kind large numbers may be captured and destroyed.

Vayssière (P.). **Two New Coccids from W. Africa.**—*Bull. Soc. Ent. France.* XVII. 1912. pp. 366-368.

Description of two new Coccids named *Pseudococcus marchali*, sp.n. and *Chionaspis nigerensis*, sp.n.

These were collected by J. Vuillet at Koulikouso (Upper Niger) upon *Xymenia americana*, the fruit of which is edible.

Russell (H. M.) & Johnston (F. A.). **The Life History of** *Tetrastichus asparagi*, Crawf.—*Jl. Econ. Entom.* (*Concord, U.S.A.*). V. No. 6. Dec. 1912. pp. 429-433.

This Chalcidid was first recorded as a parasite of *Crioceris asparagi* (the Asparagus beetle) by H. F. Fernald in July 1909. It was observed by the authors in large numbers at Riverhead, Long Island, N.Y., in the summer of 1912. A field of asparagus at Aquobogue was being cut for market and a few rows had been left as traps; the beetles and also their eggs were found on the plants in large numbers and associated with them adults of this parasite (*T. asparagi*), 5-7 being often found on a single stalk busily engaged in ovipositing in some eggs and destroying others by feeding on them (out of 2,097 eggs counted on 28 stalks 1,495 had been thus destroyed). Adults were taken to the laboratory and allowed to deposit their eggs in eggs of *Crioceris*, but instead of adult parasites emerging only the larvae came out and died from lack of food. This surprised the authors as they regarded it as an egg-parasite, but as the adult is twice the size of the host egg, it could hardly develop to maturity within it. Mr. W. H. Fiske, of the U.S. Bureau of Entomology, was of opinion that as the egg of *Crioceris* was so small the parasite must come from that of a much larger beetle and thought that a species of *Trirhabda* (Galerucidae) which feeds on *Solidago sp.* was possibly the true host and that the habit of feeding on the eggs of *Crioceris* was only acquired.

True oviposition in the eggs of *Crioceris* however was observed by the authors and the parasite refused those of *Leptinotarsa 10-lineata* (the potato beetle) and also those of *Galerucella luteola* (the elm-leaf beetle). Nearly mature *Crioceris* larvae were collected and allowed to pupate in the laboratory; one was found packed with 6 white parasitic larvae which pupated, but all died in that stage. Only a few days later numbers of *Crioceris* were bred from larvae and three pupae of *Tetrastichus* among them. Late in July the parasites were again found in the fields behaving as before; the attempt to breed them out was repeated, and this time with success, numbers of parasitic larvae being obtained. The adult insect searches for eggs immediately on emergence and the processes of feeding and oviposition begin at once. The ovipositor is used as a drill and is thrust into the egg and withdrawn continually for about 3 minutes; the insect then turns round and sucks the egg-contents through the hole so made. Some were observed to drill for at least eight minutes before sucking; the time spent on puncturing and sucking varies however very greatly. In the laboratory 13 females, living on an average 7·8 days, destroyed 260 eggs of *Crioceris*, an average of 20 each or 2·5 per diem. The largest number of eggs destroyed by one female was 61 and the largest number destroyed in a single day was 12. So far as this investigation has proceeded, reproduction is asexual only, as in two successive generations no males have been reared. Females confined in separate vials began oviposition as soon as they emerged from the pupae.

From 1-9 adults were found to emerge from a single host larva so that apparently for every egg of the parasite one adult results; polyembryony does not appear to occur.

The field of asparagus on which these observations were made was formerly sprayed regularly to keep down the *Crioceris*, but this year (1912) they were so scarce that but little damage was done, owing no doubt to the presence of the parasite.

Pierce (W. D.) & Holloway (T. E.). **Notes on the Biology of *Chelonus texanus*, Cress.**—*Jl. of Econ. Entom. (Concord N.H., U.S.A.)*. V. No. 6. Dec., 1912. pp. 425-428.

The adult *Chelonus texanus* deposits its eggs in the eggs of its host *Chloridea* (*Heliothis*) *obsoleta*, F., but the parasite emerges, not from the egg, but from the larva developed therefrom. A similar retarded development has been recorded in the case of *Encyrtus fuscicollis*, Dalm., which oviposits in the eggs of *Hyponomeuta malviella*, etc., and *Litomastrix truncatellus*, Dalm., an egg-parasite of *Plusia gamma*, etc. *Litomastrix* and *Encyrtus* are polyembryonic; *Chelonus*, so far as observed, is a single and simple parasite. The *Litomastrix* adult is only 1·9 mm. in length and the egg of *Plusia* 0·6 mm. in diameter. *Chelonus* is fully 5 mm. long and the eggs of *Chloridea* (*Heliothis*) *absoleta* are 0·5 mm. in diameter, whilst those of *Laphygma frugiperda* are smaller.

The junior author while collecting eggs of *C. obsoleta* (11th March 1911) found *Chelonus texanus* in the act of oviposition. It was taken to the laboratory and placed in a tube with about 200 *Chloridea* (*Heliothis*) eggs, in which it oviposited. The moth larvae emerged on March 13-15 and two parasites were reared, of which one (male) died. The other was supplied with eggs of *C. obsoleta* on a piece of corn-leaf; it examined both and forthwith began to oviposit.

In September 1912 *Chelonus texanus* was observed ovipositing in the eggs of *Laphygma frugiperda*. Fifty-seven broods of *Laphygma* larvae were kept under observation and from twenty-five of these *Chelonus* was bred. Cocoon formation took place within an average of 26 days. When about ⅓-inch long the parasitised *Laphygma* larva makes a cell supported by a fine-meshed yellow silk cocoon, and two days after completion the larva dies. The next day the parasite larva emerges from a hole about the middle of the body and spins its cocoon within that of the host, taking two days in the process. The time of emergence depends entirely on the size of the host. If it grows and feeds slowly, so does the parasite within. The presence of the parasite causes the premature spinning of its cocoon by the host.

This habit of oviposition may not be characteristic of all species of *Chelonus*. Silvestri (La Tignola dell' Olivo, Portici, 1907, pp. 154-57) describes *C. elaeaphilus* and *C. orientalis* as probably laying their eggs in the very young larvae of their hosts.

Bryant (H. C.), Assistant California State Fish and Game Commission, Univ. Zool. Lab., California. **The Numbers of Insects Destroyed by Western Meadow Larks** (*Sturnella neglecta*).—*Science, N.S.* XXXVI. 20th Dec., 1912. pp. 873-874.

There is little definite information as to the exact number of insects destroyed by birds within a given area. The food habits of certain Californian birds are now being investigated by the California State Board of Fish and Game Commissioners and the University of California, and it has been possible to collect birds in sufficient quantities for stomach examination in some 20 different parts of the State and in every month of the year.

Ranchers of the State complain greatly of the pulling of sprouting grain by the Western Meadow Lark (*Sturnella neglecta*). Of this the bird has been found guilty, but the evidence as to its value as a destroyer of insects is of greater interest.

The averages for the year are as follows:—64·6 per cent. animal food, 35·4 per cent vegetable food; including, 7·6 per cent. beetles, 18·3 per cent. cut-worms, 26·4 per cent. grasshoppers, 22·2 per cent. grain. In March the percentage of beetles was 22·7, and in October 0·5. The percentage of cut-worms was 69 in May, and none in the months of July, August and October. The highest percentage of grain was 94 in January and 47·1 in October; in the months of April, May, June and September, none. The highest percentage of grasshoppers was 85·5 per cent. in July and only 4 per cent. in May. Grasshoppers were only found in the months of May, June, July, August, September and October. It thus appears that grain is only resorted to when insects are not available. Beetles are eaten all the year round.

The percentages given represent the comparative volume of the different kinds of food found in the stomach. In the case of cut-worms, the number is greatest when the worms are still small; thus, in February twelve birds were found to contain 360, in March 16, in April 68, in May 90, and in June 6; whereas the percentage based on volume was the highest in May (44·7) with 90 worms, the February percentage being 36·8 with 360 worms.

Meadow Larks are apparently very valuable as checks on the increase of grasshoppers; *e.g.*, 66 birds between the months of June and November 1911 were found to have eaten 738 of these insects. The largest percentage was in September, 96·3 by 6 birds and the largest average number 16·5 by 19 birds. The number of grasshoppers was estimated by counting paired mandibles.

Experiment has shown that a Meadow Lark will digest a grasshopper in between 3 and 4 hours. The numbers found in the stomach therefore represent those which had been eaten during the preceding 3 or 4 hours before the birds were killed.

In order to obtain some idea of the number consumed in a day, the average number per bird needs to be multiplied by 4, and it seems safe to conclude that the particular Meadow Larks examined were averaging almost 50 grasshoppers a day. As many as 28 pairs of mandibles were found in a single stomach.

Not all the grasshoppers destroyed can of course be considered injurious, but the main point is, that if the birds feed on insects to the extent shown in this instance, they must play a more important part as checks on the number of insects than many people would have it to be believed.

The consumption of injurious beetles was considerable. The stomach of one Meadow Lark, taken on the 20th November 1911, contained over 36 Chrysomelid beetles of the species *Diabrotica soror*. As this species is very destructive in the State, and as insecticides are seldom used, any natural check is of importance and should be recognised.

The author urges that the facts above stated are strong arguments for the protection of many birds whose economic value is now considered doubtful.

Johnson (J. C.). **Formalin as an Insecticide.**—*Irish Naturalist.* XXII. Jan. 1913. p. 19.

Owing to the remarkable efficiency of formaldehyde as a germicide and fungicide, some experiments were made in the plant-houses of University College, Cork, to determine its insecticidal power. Various solutions of Schering's formalin in water were used, giving strengths of formaldehyde of from 0·01 per cent. to 2·0 per cent. These were sprayed over plants infected with green fly and mealy bug. The results showed that any efficacy formalin might possess as an insecticide was more than counterbalanced by its injurious action on the plants.

Picard (F.). **Sur la production par le Phylloxéra de le Vigne de galles inversées sur les feuilles de *Vitis berlandieri*, Planchon.** [On the production by the Phylloxera of the Vine of inverted galls on the leaves of *Vitis berlandieri*, Planchon.]—*C.R. heb. Soc. Biol.* 6th Dec. 1912. pp. 559-561.

It is known that the gall-producing individuals of *Phylloxera vitifoliae*, Ficht, 1854 (= *vastatrix*, Planchon, 1868) do not behave in the same way on different species of vine. These galls are numerous and well developed on *V. rupestris*, Scheele, *V. riparia*, Michx., and especially on the hybrids of *V. riparia* crossed with *rupestris*; but scarce and smaller on *Vitis aestivalis*, Michx., and *labrusca*, L.; and very rare and almost always abortive on *Vitis vinifera*, L. This abortion which is the rule in the European vine is frequently observed in certain American stocks, *e.g.*, varieties of V. *aestivalis*.

It appears to be admitted on all sides that the insect always punctures the epidermis of the upper side of the leaves, producing a gall which projects on the lower surface with its opening above, and no example of a different arrangement could be found in the bulky literature of *Phylloxera*.

At the end of the summer of 1911 the author found an example, in the Museum of the School of Agriculture at Montpellier, of

leaves of an American vine, *Vitis berlandieri*, in which the galls were inverted, that is to say the opening was on the under surface of the leaves. The author found that this condition appeared to be a peculiarity of *V. berlandieri*, as he failed entirely to find it on European stocks or on other American species and their hybrids, which however bore thousands of galls of ordinary structure in the past year. Topi has recorded similar cases in Italy, and according to him, it is the fourth generation of the insect which attacks the leaves in this peculiar manner, the reason assigned being the dryness of the weather at the time, which arrests the growth, and the insects appear to be unable to puncture the upper surface and therefore turn to the lower. Many of these galls are badly formed and badly closed, so that the eggs are often liable to be lost.

The author cannot agree with this explanation, because in the wet summer of 1912 he found these inverted galls quite as abundant on *V. berlandieri* as in the dry summer of 1911 and further, they are not found on any other stock. He attributes it to some difference of structure in the leaf.

Allard (H. A.). Bureau of Plant Industry, Washington, D.C. **The Mosaic Disease of Tobacco.**—*Science*. N.S. XXXVI. No. 938. Dec. 30, 1912. pp. 875-876.

The Mosaic Disease of tobacco has generally been regarded as of physiological origin, but new facts have come to light which tend to modify this opinion, in that insects appear to be involved. No difficulty has been found in transferring the disease by inoculation to plants of the following genera:—*Nicotiana, Lycopersicon, Petunia, Physalis, Datura, Hyoscyamus, Solanum* and *Capsicum*. There is also evidence that the disease sometimes occurs in strictly wild plants. Attempts to inoculate the common potato, the egg-plant and belladonna failed, and two species of *Nicotiana, N. glauca* and *N. viscosa*, resisted inoculation.

The author's experiments tend to show that the conclusion from early investigations, that a true infectious mosaic can be produced in plants by simply cutting them back, is incorrect. Healthy plants were constantly cut back, sometimes for long periods, without producing any symptoms of true mosaic; but this was not accomplished until thorough methods of sterilising were observed, and the plants had been carefully screened and fumigated to exclude aphids.

The author is of opinion that mosaic in young plants is in no way connected with soil infection. He observed, however, that there appears to be a relation between the disease and aphid infestation. Healthy tobacco plants were always obtained if grown in screened cages fumigated at short intervals, but when aphids were introduced into cages containing healthy plants, wholesale mosaic infection took place. The matter is still under investigation.

KEILIN (D.). **Structure du pharynx en fonction du régime chez les larves de Diptères cyclorhaphes.** [On the structure of the pharynx in relation to the food of the larvae of cyclorrhaphous Diptera.]—*C.R. Acad. Sci.* No. 26. 23rd Dec. 1912. p. 1550.

The author enumerates the food of a number of genera of Diptera and says that, as a result of this enumeration, it follows that all the larvae of the cyclorrhaphous Diptera which are parasites of the most various kinds of animals or of plants, as well as carnivorous larvae, and larvae which suck the blood of mammals, never possess ridges in the pharynx, whereas on the other hand these ridges are always to be found in saprophagous larvae.

In one and the same genus female larvae may be found with or without ridges, according to their mode of life. A knowledge of these facts greatly assists the biological study of larvae, enabling us to classify decisively according to the food, and not merely according to the material in which the larvae may happen to be found. This is illustrated by several instances.

The examination of the last cast larval skin, enables the structure of the pharynx to be studied and the biology of those forms of which the pupa only is known can be reconstructed. Lastly by the presence or absence of ridges in the pharynx there is no difficulty in separating the true parasites of plants, of animals, and especially of man, from those which penetrate into the organism as the consequence of some local malady following upon bacterial infection, and behaving as saprophagi feeding upon material previously modified by these microbes.

El gusano de la caña en Costa Rica. [The Sugar-Cane Bug in Costa Rica.]—*Bol. de Fomento, San José, Costa Rica.* No. 7. 1912. pp. 466-469.

This scale-insect (*Pseudococcus sacchari*) is reported as spreading rapidly in the country and active measures against it are being organised. Specimens were sent to Washington and identified by Mr. T. E. Holloway, of New Orleans, who in his report says that Johnson grass (*Sorghum halepense*) and practically all the sugar-yielding Sorghums are attractive to these insects and should be kept down in and around the sugar plantations. The pest is largely spread by carelessness in the transport of cut cane. The principal natural enemy of the *Pseudococcus* is a Coccinellid beetle, *Crytolaemus montrouzieri*, which lays its eggs in the woolly masses of the Coccid, and these are consumed by the larvae as soon as they emerge. These beetles flourish in the gardens at Audubon Park, New Orleans, but cannot resist the cold winter. A small number of them was supplied to the Costa Rica authorities, from the Horticultural Department of California, and it is hoped that as the climate of Costa Rica is warmer than that of the United States, the insects will become acclimatised and multiply.

Another useful Coccinellid enemy of the *Pseudococcus* is *Scymnus intrusus*, a beetle much smaller than *Cryptolaemus*,

There is also a species of *Aspergillus* which in damp weather grows on the *Pseudococcus* and destroys it. Whale-oil soap emulsion is useful in keeping down the pest, but the burning of all cane waste is especially recommended as thereby other pests, notably the Cane Borer, are destroyed.

Corn Worm, also known as the Grain Weevil.—*Queensland Agric. Jl.* Nov., 1912. p. 383.

It is recommended that before grain is put away in tanks or other places it should be perfectly dry. Bisulphide of carbon at 1*s.* per lb. and naphthalin at 9*d.* per lb. are the principal substances used for keeping weevil and moth from grain.

The following method of using bisulphide is recommended:—

The dose for each 400 gal. tank is 4 oz. A suitable bottle of this or somewhat larger capacity is taken, a hole is made in the cork, a strong cord passed through the hole and knotted or otherwise secured on the under side; the cord should be about 5 feet long. Next a piece of wood with a hole in it large enough to allow the neck only of the bottle to pass and to rest upon the shoulder, and long enough to obtain a good grip on the grain when piled upon it, is slipped over the neck, the bisulphide is poured into the bottle and the cork and the hole in it made thoroughly airtight with putty. The bottle thus fitted is put at the bottom of the tank and the grain filled in. When full the cork is pulled out by means of the cord, the lid of the tank being then put on quickly and made tight everywhere with putty.

Another method is to take a length of stout bamboo perforated with gimlet holes at intervals. These holes are to be covered over with pieces of sacking or other material to prevent the grain blocking them. The bamboo is then set vertically in the tank and the grain filled in. A stick or rod which will pass down the bamboo is then taken, a plug of cotton waste being fitted to one end, the bisulphide is poured into the bamboo, the rod and plug quickly inserted and plugged at the top with cotton waste, the cover of the tank put on and made tight as before. Naphthalin may be used in the same way; 4 oz. dropped into the bamboo tube followed by a plug of waste, then another 4 oz. and a plug and so on till the bamboo is full; it is then set up vertically in the tank which is closed as before.

A similar plan may be adopted for heaps of maize or other grain. For large heaps, similarly charged bamboos should be laid horizontally, one for every 18 in. of depth. A hole in the bamboo at every foot will in this case be sufficient.

Of the two processes, naphthalin may be roughly termed a preventive, and bisulphide a cure, as it is a sure means of destroying any weevil or moth present. The tanks should be opened up periodically and the grain well stirred to retain vitality. The germinating power of the seed should be tested at intervals.

Some 10 years ago an American farmer discovered accidentally that salt prevented the attack of weevil. He sacked a quantity of cow-peas and one-fourth of the sacks used were salt-sacks with

the salt still clinging to them. When marketed he found those in the salt-sacks were in perfect condition, those in the others being almost destroyed by weevil.

It has been suggested that maize might be stored in husk, but it is the husk in which a great many weevils secrete themselves and afterwards destroy quantities of the grain. The same farmer knowing this, dissolved a quart of salt in 2 gallons of water and as the unhusked cobs were thrown into the barn he gave each layer a slight sprinkling of this salt solution. There was no weevil damage, and he has, he says, used this simple remedy ever since with perfect success.

MAYNÉ (R.), Entomologist to the Belgian Congo. **A serious pest of *Coffea arabica: Bixadus sierricola*, Wh.**—*Bull. Agric. Congo Belge.* III. No. 4. Dec. 1912. pp. 911-917.

Before the taking over by the State of the station of Lemba (Lower Congo) which has now been transformed into an experimental garden, a variety of *Coffea arabica*, obtained originally from San Thomé, was cultivated there. The trees were attacked by *Bixadus sierricola*, White, which was one of the principal causes of a serious reduction in the yield of coffee.

This Longicorn is already known as a coffee pest in W. Africa and Von Faber has compared its ravages with those of *Moecha adusta*, a Longicorn pest of cacao; the writer finds, however, no resemblance in the damage caused by the two insects. The coffee pest confines its attack to the part of the trunk just above ground. The cacao pest bores a long burrow in the main trunk and larger branches. Morstatt has described similar damage done by an allied species, *Anthores leuconotus*, Pasc. (*Herpetophygas fasciatus*, Fåhr.) to coffee trees in the Moschi district of Usambara.

Reproduction in the case of *Bixadus* is annual. The first adults are to be seen during October, at the beginning of the rainy season, and the last hatch out in December. They are to be found on the coffee trees in the morning and occasionally on other trees near by. Eggs are laid about the end of September and possibly as late as the end of December. The writer has been unable thus far to fix the duration of the egg stage or the precise date of hatching; but he found larvae in a few trees late in March. The larvae go on burrowing up to August and September, when pupation takes place. A number of observations has established the duration of the pupa stage at 30-45 days. The insects are to be met with from October to January.

The place of oviposition is generally 15-20 cm. (6″-8″) above ground, in a fold of the bark at the point of intersection of a secondary branch or in a cicatrised wound. Young trees (3 years) are rarely attacked; trees of 4-5 years or old trees are generally selected and suffer most. There is no preference shown for feeble trees. The larval stage, during which *Bixadus* does the real damage, may be divided into 3 distinct periods: – (1) The young larva gnaws the bark and the cambium layer; (2) the

larva penetrates into the root; (3) the larva returns to the earth level and remains in the woody and cambium zones, but especially in the former.

In stage (1) the burrows are flat, somewhat sinuous and descending, destroying the cambium layer and the bark, occasionally reaching the exterior. When the ground-level is reached the larva begins to attack the wood, blocking the burrow behind it as it goes with "frass" to protect itself against its most dangerous enemies—the ants.

The greatest damage is done in stage (2) in the root, the burrow generally cutting the intersection of the first secondary root with the primary. The larva then burrows wide galleries in the wood, but generally returns to the surface, destroying the bark and part of the wood 5 or 6 cm. (2″-2½″) above ground. White ants and fungi complete the work and the root is soon detached entirely, the tree being weakened and its hold on the ground imperilled. The tree makes vigorous efforts at repair, but the further attacks of *Bixadus*, white ants, the larvae of Elaterids and other Coleoptera complete the destruction.

The aspect of an attacked tree is characteristic. It leans over owing to the root damage; suckers are thrown off from the principal inclined branch, but these are rarely productive. In a few years the tree dies, having lost practically all its roots.

After completing its sojourn in the root the larva mounts to the wood above and burrows large galleries, some upwards, some downwards, but quite irregularly. Arrived near the surface, it excavates a large cavity in which to pupate. The holes through which the insect emerges are large and plainly visible.

Methods of destruction.—Capture of the insects can only be regarded as supplementary to other measures. Destruction of the larvae is difficult and hardly practicable, especially in the third stage. The best plan seems to be to seek the larvae in the bark about March. If a plantation be well watched the attack can often be detected by the presence of corky lumps on the bark or by "frass" on the ground beneath the tree; the larvae may then be tracked under the bark.

Carbon bisulphide injected into the burrows has been tried, but the "frass" plugging prevents its taking effect. The best plan appears to be to bore a hole with a brace and bit across the possible line of the burrows, introduce a wad soaked in bisulphide and then close the hole quickly with a plug of clay, painting the outside over with tar. Mixtures of petroleum and bisulphide have given the best results and 4-5ths of the trees attacked have been cleared of these insects by the free use of this mixture. The best time to operate is September.

Preventive measures are the most to be recommended and chiefly the protection of the tree from a fresh deposit of eggs of *Bixadus*. The insects leave the pupal chamber by a hole which is just below ground; the roots must therefore be exposed sufficiently to uncover this hole; this part of the trunk is then lightly scraped to 40 cm. (16″) up and coated with coal tar. This should be done in the latter half of September and at the same time all old bore-holes should be plugged with clay. In

order to help attacked trees to resist the wind, they should be earthed up. Another method recommended by Banks against a Longicorn beetle (species as yet undetermined) popularly known as the "flat-head borer" consists in painting the tree with the following mixture instead of tar: soft soap 4 parts, hot water 4 parts, carbolic acid ½ part, all by volume; let the mixture rest for 24 hours and add 32-40 parts rain water, then stir well till mixture is complete.

In large and badly infested plantations the most practical method is to destroy the whole by fire and not cultivate coffee on the same land for some years.

[Fortunately the author has figured the species to which he refers, and it is possible to say definitely that it is not *Bixadus sierricola*, White. So far as can be judged from the figure, the species is almost certainly an *Anthores*, and probably the common East African coffee-borer, *A. leuconotus*, Pasc.—Ed.]

Patch (Edith M.). **Elm-leaf Curl and Woolly Aphid.**—*Maine Agric. Expt. Sta., Orono.* Bulletin 203. 1st Nov. 1912. pp. 236-258. 3 plates.

Certain aphides are now known to appear under two forms, *e.g.*, *Chermes abieticolens*, Thomas, of the red spruce is conspecific with *C. pinifoliae*, Fitch, of the young white pine, etc.; and these alternations of food plants point to possible means of control.

The author found it impossible to separate, on structural characters, collections of *Schizoneura americana* (causing elm-leaf curl) from *S. lanigera* (the woolly aphid of the apple). In some cases the antennal differences were great and in others the only distinction was the tree from which the specimens were taken. A study of the antennal variations in nearly 1,000 individuals is in the press.

Leaf curl from elm, with pupae and alate forms, were obtained from the south and the winged insects were caged over clean seedling apples; unmistakable woolly aphids of the apple resulted. In some cases the nymphs died, the particular seedlings being presumably aphid resistant.

The common forms on the roots and stems of apple trees are wingless and not more that 1-10th inch in length, of a reddish brown colour and abundantly covered, especially those above ground, with a flocculent waxy secretion.

In autumn winged females appear in abundance, being small, clear-winged insects, almost black, with the body more or less covered with cottony secretion. These are the autumn or return migrants that seek the elm bark to give birth to the generation of true sexes—minute wingless, beakless creatures, the female of which deposits a single "winter egg" within a crevice of the elm bark. On the elm, the stem mother, which hatches from the over-wintering eggs, appears in the early spring and may be found in Maine, before the middle of May, stationed on the partly opened leaf buds. By the end of the month the earliest of these wingless stem mothers are mature and found in the leaf curl or in the

"rosette" (terminal leaf curl when a group of terminal leaves is affected) which they cause; the next generation is also wingless. In the summer great numbers of wingless individuals are produced. The migration from the elm leaves of these summer migrants is either partly to apple and partly to elm bark, or elm bark colonies as well as leaf curl may be established by the first or second apterous generations. This does not account for the generations resulting from the over-wintering forms on the apple roots and their sequence remains to be studied. The autumn migration of the woolly aphis from apple and the mountain ash has been observed by the author, but she has not been able to link it with the true sexes on the elm. That inference, however, from the evidence of the spring migration to apple, the author regards as unmistakable.

Migration from elm leaf to apple and mountain ash, under normal out-door conditions, was established in the summer of 1912. *Pyrus americana* and introduced species of mountain ash are favourite summer hosts in Maine. The author effected the migration to mountain ash artificially, the aphides bred and thrived quite normally. The sequence of generations is as follows:— *Egg*: 0·5 mm. long, gamboge-yellow inclining to brown; in crevices under elm bark. *Stem mother*: purplish red when mature, about 3·5 mm. in length. *Second generation*: apterous viviparous forms, never so large as the stem mother, inhabiting leaf curl and giving birth to migrants. *Third generation*: winged viviparous females, variable in size; these develop within and migrate from elm-leaf curl to apple, producing young which live on apple. *Fourth generation*: differs from the preceding in the "pro-muscis" being much longer; antennae have 6 joints and no annulated constrictions; colour orange; deposited on apple by the spring migrants and develop there in flocculent masses; individuals move to other parts of the tree and establish new colonies. *Fifth generation*: second apterous generation on apple bark; practically the same as the fourth. *Sixth (?) generation*: the woolly colonies on apple, mountain ash and *Crataegus* migrate to elm bark to deposit their progeny, the true sexes. Together with these, in the same woolly colonies, develop apterous viviparous females that give birth to nymphs which seek the roots of trees and hibernate there, surviving the winter if conditions are favourable. *True sexual individuals*: this generation seems to have no object in life beyond the deposition of eggs since they can neither eat nor fly.

The danger from the woolly aphis is greatest to nursery stock and to young orchards. From 20 to 40 million seedling apples are raised in the United States every year and 20 per cent. to 25 per cent. of these become infested. The insect has also become a serious pest of the white elm (*Ulmus americana*), now largely grown as a shade tree.

Preventive and remedial measures.—The knowledge that the aphis of elm-leaf curl is identical with that of the apple points to the removal of nurseries from the neighbourhood of elms as a good preventive measure, and where apples are grown, elms should not be planted as shade trees.

The usual tobacco and other washes, especially if applied warm, are effective against the aphis when accessible, but care should be taken that they are used in sufficient quantity and applied with sufficient force to penetrate the woolly covering. The root-feeders are more difficult of access; strong soap or tobacco washes applied to the soil above the crown; soot, ashes and tobacco dust, lime and gas lime buried about the roots are remedies in use. Badly infested nursery stock should be destroyed.

Insect enemies of the woolly aphis.—In the elm-leaf curl, at least in Maine, the woolly aphis is vigorously attacked by a predaceous Capsid bug (*Camptobrochus nitens*), by the larvae of a Coccinellid and by *Syrphus* maggots; in other parts of the country the aphis is preyed upon while in the elm-leaf to such an extent that consignments sent to the author often yielded more enemies than pests.

The list of enemies of the woolly aphis recorded by Riley (1879) and Marlatt (1897) is quoted, including Coccinellid beetles, Capsid bugs, Syrphid flies, and a Lepidopterous larva, *Enarmonia (Semasia) prunivora*, Walsh.

Lacewing flies are very destructive to *Schizoneura lanigera* in Colorado, where Mr. Taylor concluded that they did more than all else to subdue the unusually severe outbreak of woolly aphis in Grand Valley in the early summer of 1907. The Capsid, *Camptobrochus nebulosus*, Uhl., commonly feeds upon it in Colorado. The bulletin concludes with a list of food plants, synonymy and literature.

The Cyprus Journal. No. 27. Oct. 1912. p. 655.

Early in January the Government received a consignment of a material called "Corvusiene" which it is claimed will clean seeds from insects; it is also said to be a remedy against "sirividhi," and to protect seed against birds. One hundred grains of corn treated and the same number not treated with Corvusiene were exposed on a house roof; the treated grain remained untouched after 2 months. The overseer of the Experimental Garden, reporting on experiments with this material at Kaimakli, says that in addition to keeping off the birds the preparation protects the grain from insect attack. It is claimed that it is very effective against some forms of smut and rust.

Nemery (—). **Bee Culture in the Kasai.**—*Bulletin Agricole du Congo Belge.* III. No. 4. Dec., 1912. pp. 934-937.

Bees are widely distributed in the district. They are generally to be found in the hollows of trees. The natives collect the honey and wax by first cutting down the tree in which the nest is found, they then smoke the insects, carrying on their operation without the slightest care and without seeking to separate the products. They pay little or no attention to bee culture.

Swarming takes place in the months of September and October, that is at the commencement of the rains. One colony may yield as many as 4 swarms in a season, but they are then small and do

not weigh more than about 2 lb. The swarms travel for a long time, sometimes several days, before finding a settling place which suits them. This is possibly due to the smallness of the shelters which the bees occupy and which they abandon one after the other until they find a resting place of sufficient size. Travelling swarms are sometimes so numerous that on some days several may be seen to pass the same spot. On one occasion 7 were so observed. Attempts at apiculture have been made at Bena Bibele with some success though for a time the native bees could not be reconciled to the type of hive used, "Dadant Blatt" and "Layens."

They have to be tempted with sugar to enter the hives, the openings of which should be towards the west, not to the south. The sun's rays should not be allowed at any time to strike the walls of the hives, otherwise the heat is more than sufficient to melt the wax and break down the comb. Although the Congo bees are very active, they do not leave the hive during the heat of the day, *i.e.*, between 11 in the morning and 3 in the afternoon. They have many enemies, and of these the white ants are very formidable. It is possible to keep them away from the hives by covering the legs of the tables on which they stand with cloths dipped in cresylatine, the odour of which appears to be exceedingly repugnant to termites. A broad circle of ashes spread round the hives seems also to prevent attack.

Another enemy is a species of wasp which catches the bees on the wing at the entrance to the hives and carries them off to its nest. Sometimes these insects are to be seen in great numbers on the table in front of the hive. The best way of getting rid of them is to kill them *in sitû* with a switch.

Arbulot (—), dealing with bee culture in the Upper Kasai, says:—

Bee culture is widely spread throughout the Upper Kasai. From Katola to Dilolo and all around these places, as well as along the frontiers of Angola, the natives practice bee culture, but apparently do not regard it as of much consequence. The native hive is made from the wood of a tree of large diameter. They take sections of a trunk, 1-1½ metres long, removing the bark in the form of a cylinder and fitting the interior with wooden supports for the combs. The two extremities are closed, with an aperture for the bees in the centre of each. These hives are generally hung in trees at a height of 3 to 5 metres. Swarming takes place twice a year, the first in May and June and the second in September and October. A species of wasp very common in the district is a great enemy of the bees. There are also two animals in this part of the Colony which pillage the hives. They are called by the natives *Tchimbulu* and *Katcha* respectively. The former is as big as a large wild cat and has black fur; the latter is a dark red, spotted with black. They are very difficult to capture even with traps.

The natives are very fond of honey and use it as a medium of exchange. They make a fermented drink from it and frequently mix it with their food. The wax is marketed by them in

Portuguese territory at Kafungo, Mahico, and near Lake Dilolo. It is sold in blocks of 5 kilos at 2 fcs. a kilo. The trade has been stopped on account of the very great rise in the cost of transport which has recently taken place.

DE CHARMOY (D. d'E.). **Report on *Phytalus smithi*, Arrow, and other Beetles Injurious to the Sugar Cane in Mauritius.**—Port Louis Govt. Printing Office. 1912. pp. 1-35. 8 plates and 1 map.

In July 1911, several beetles were received from a sugar estate in the north of the Island and reported as doing much damage. On 28th July the estate was visited and it was decided to take official action to limit the ravages of the pest.

Plantations of young canes 4 months old had been utterly destroyed and beans, "Pois sabre" (*Canavalia ensiformis*), growing between the furrows had completely disappeared. In older canes (rattoons) the roots were being rapidly destroyed. The insects were found on two estates only, and between 26th Dec. 1911 and the end of April 1912, 1,165 had been collected on one of these estates. Enquiries made in Natal, Cape Colony and Ceylon showed that the pest was unknown in any of these Colonies, and Mr. G. J. Arrow, of the British Museum, pronounced it to be a new species, which he has described under the name of *Phytalus smithi* (MELOLONTHIDAE).

The insect is known in Barbados, where it damages cane roots to a small extent; Mr. Arrow being of opinion that a parasite keeps it in check. It may have been introduced into Mauritius with a cargo of mules from South America.* It is also possible that it has come over from Barbados with samples of rooted canes. The first recorded specimen was captured four years previous to this outbreak. The means adopted for destruction were, ploughing, with men following and picking up the grubs; and where the plough could not be used the ground was hoed, but the cost was more than double and the result by no means so satisfactory. After harvest, all fields of 3rd and 4th rattoons were cleaned and the stumps removed; the larvae were found almost entirely on or near the roots. The 1st and 2nd rattoons were dealt with by laying bare the roots and picking off the larvae; when the owners objected to this method as likely to destroy the canes, petroleum emulsion, containing 1 per cent. creoline or carbolic acid, was used at the rate of about 10 litres (7½ quarts) per stump. The results of these operations were satisfactory, and by the end of October 1911 over a million and a half of insects had been destroyed and it was hoped that the pest had been subdued. On 4th September the capture of adults after dark was begun. Fires proved useless, so gangs of men with lanterns were employed; at first this plan was not very successful, 10 men capturing only 166, on coffee plants, in a fortnight, but

* [There is not at present any valid evidence for this suggestion, as the species has not yet been authentically recorded from any locality other than Barbados and Mauritius.—Ed.]

as the insects increased, 376 were taken on one estate, 76 on another, and 980 on a third in 50 days; by 4th October, 58,991 had been taken. The men were at first paid 40 cents of a rupee per hundred, but in December, when the insects literally swarmed, this was reduced to 5 cents; by March the price was raised to 50 cents. Altogether from August 1911 to April 1912, no less than 27,520,471 were taken at a cost of Rs. 71,575 by the various methods employed. Special attention was paid to the collection on the borders of the infested areas so as to prevent spread to neighbouring plantations, on which the presence of a few insects might have been neglected and thus given rise to fresh foci.

The method of cultivation of the cane in Mauritius prevented the use of insecticides, as these, to be efficacious, must be mixed intimately with the soil. Paris Green and "Vaporite" proved useless, and potassium cyanide was only effective when it came into actual contact with the larvae. Injection of the soil was far too costly (Rs. 350 per acre). "Durandine" and petroleum emulsion, consisting of a 1 per cent. solution of the former and a 7 per cent. solution of the latter, gave very good results, but the cost is prohibitive. "Sulphides" were tried and proved ineffective. Petroleum and creolin emulsion gave the best results, from the point of view of both efficiency and cheapness. It is prepared thus:—500 grams of common soap dissolved in 9 litres of boiling water; add slowly 18 litres petroleum and stir till the liquid is quite viscid; to 800 cc. of the emulsion add 200 cc. creolin, or to 700 cc. add 300 cc. phenyl; to either of these mixtures add 100 times their volume of water. Ten litres to each cane hole is sufficient. Carbon bisulphide could not be used, as none could be obtained locally, and the cost would probably be prohibitive.

During the day the beetle lies buried in the ground at a depth of 5-8 in. Soon after dark it emerges, flies to the nearest bush or hedge, and starts nibbling the leaves in regular arcs; before dawn it again retires underground. The hemispherical notches in the leaves are quite characteristic and give a certain clue to the presence of the insects. The adult does little damage; anything green seems acceptable but there is a marked partiality for the leaves of *Cordia interrupta* and the hunters soon found that branches of this shrub stuck in the ground helped them greatly to increase their catch. Light does not attract the beetles and a powerful beam only renders them motionless; shaking the plant causes them to drop off at once. They are rarely seen on the wing and never fly far; so that, despite the prolificity of the insect, it has not spread very far. Adults are apparently met with all the year round. For the nine months from Sept. 1911 to April 1912 the captures (in thousands) were respectively 81, 1,250, 5,655, 17,492, 1,052, 469, 125, and 185. A captured female took four months to deposit 46 eggs, and it appears that the first batch laid is rarely less than 15, so that the total number of eggs seems to be about 60. They are never laid in clusters, but individually at a depth of 4-6 ins. below the surface. The laying of eggs appears to go on practically all the year round. The incubation period is 15-18 days, but in December may be as

short as 7 days; the incubation period of eggs laid on the same day by the same female under identical conditions sometimes varied as much as 48 hours.

The larva so closely resembles other Lamellicorn larvae that knowledge is required in order to distinguish it from the larva of *Adoretus* (RUTELIDAE) for example. The duration of this stage has not yet been determined, but it is estimated at 6-8 months. The larvae begin to be torpid in October, gradually stop feeding and penetrate deeper into the soil, where they enclose themselves in a cell of agglutinated earth 20 mm. long, rough externally but smooth internally. Within this cell the larva passes through the pre-nymphal stage and after 6-8 weeks is transformed into a pupa from which the imago will emerge 18-25 days later.

The larva moves but little from the place in which the egg from which it emerged was deposited and only changes its feeding ground under necessity. It devours the roots of beans and manioc exactly as it does the roots of sugar cane and will attack other plants, though it exhibits a marked partiality for sugar cane. A rich, humid, loamy soil suits it best; on dry or rocky ground at a higher level it was far less abundant. It is calculated that 14,400,637 females were killed in the campaign; assuming an average of 50 eggs per female, 720 million potential pests were destroyed.

Mr. Arrow has discovered on larvae received from Barbados a parasite which he believes is a larva of a *Scolia*,* so that reasonable grounds exist for assuming that this parasite might prove a valuable auxiliary in combating the pest.

A local fungus disease attacking *Phytalus* has been discovered and is under experiment, and samples of the Hawaiian beetle-fungus have been received with the hope of infecting *Phytalus smithi*.

Other Beetles Living at Roots of Sugar Cane in Mauritius.

Adoretus versutus (RUTELIDAE).—A common pest, attacking all trees, cultivated or wild; found at night in great numbers all the year round, except July-September. Ornamental plants and fruit trees are completely defoliated. It has been noticed however that the imago does not feed on lemon and orange trees, sugar cane, sorghum, &c. In the larval stage it is injurious to all plants and causes great damage. Though found throughout the year, it literally swarms from October to May. The beetle flies at night, burying itself in the ground by day. The best remedy is to catch the beetles by lanterns after sunset and throw them into water. The trees should not be shaken as the beetles fly instantly or drop to the ground.

Adoretus compressus is smaller and less common, and not such a serious pest.

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* [Mr John R. Bovell, Superintendent of Agriculture, Barbados, has sent home specimens of this parasite, which he has bred; it proves to be *Tiphia parallela*, Smith, a species which occurs also in Central and South America.—Ed.]

Serica sp. nov. (MELOLONTHIDAE) is found in great numbers in November in harvested cane fields, but it has not been possible to ascertain the extent of the damage done.

Oryctes tarandus, Ol. (DYNASTIDAE).—One of the largest of the beetles of Mauritius. Three species of *Oryctes* are known in Mauritius under the vernacular name of *moutoucs*. They were not regarded as very destructive of the sugar cane, even in damp localities where they sometimes entirely destroy old stumps. The real damage done by the *moutoucs* was not suspected until the scare caused by *Phytalus* took place, when in August 1911 on one estate 122 acres were uprooted and 311,000 *Oryctes* larvae were found. The practice of burying cane trash to enrich the soil between the rows is probably largely responsible for the increase of *Oryctes*. They are attacked by the fungus which also infests *P. smithi*. *Gymnogaster buphthalma*, Blanch. (MELOLONTHIDAE) very closely resembles *P. smithi* and has been collected in great numbers at cane roots, destroying the stumps in the same manner. *Agrypnus fuscipes*, F. (ELATERIDAE) is found in small numbers on cane roots; the nature and extent of damage done has not been ascertained. *Eutochia fullo*, Eric. (TENEBRIONIDAE): very common in the cane fields; the larvae injure cane cuttings by destroying the eyes; they also attack maize seeds in the ground. *Opatrum crenatum* (TENEBRIONIDAE): even commoner than the previous species and with the same habits. *Cratopus punctum*, F. (CURCULIONIDAE): very common; attacks the tender leaves of all kinds of plants, sometimes defoliating them completely. *Trochorhopalus strangulatus*, Gyl. (CURCULIONIDAE): not uncommon in young virgin canes, when old uprooted stumps have been buried or left in the interlines; often attacks cuttings and even the stalks.

Other Insects attacking Sugar Cane in Mauritius.

Lepidoptera.—SATYRIDAE: *Melanitis leda*, L. NOCTUIDAE: *Cirphis (Leucania) unipuncta*, Haw.; *C. loreyi*, Dup.; *Sesamia vuteria*, Stoll (*nonagriodes*, Lef.); *Spodoptera mauritia*, Boisd. PYRALIDAE: *Diatraea striatalis*, Sn. TORTRICIDAE: *Grapholita schistaceana*, Sn. TINEIDAE: *Alucita sacchari*, Boyer.

Hemiptera.—APHIDIDAE: *Aphis sacchari*, Zehnt.; *Tetraneura lucifuga*, Zehnt. ALEURODIDAE: *Aleurodes bergi*, Sign. COCCIDAE: *Dactylopius calceolaria*, Mask.; *Sphaerococcus bambusae*, Mask.; *Chionaspis tegalensis*, Zehnt.

NOTICES.

The Review of Applied Entomology is intended to contain, month by month, abstracts of the latest information published concerning insects injurious to man or animals, as the carriers of disease; and to forests, fruit trees, crops or stored merchandise.

The Editor will be glad to receive prompt information of the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion, the adoption of which would increase the usefulness of the Review.

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CONTENTS.

	PAGE.
Bee Culture in the Kasai (Belgian Congo)	26
Cacao pests in Central Java	3
Camphor Trees, Pests of, in German East Africa	11
Chelonus texanus, Notes on the Biology of	16
Coccids, Two new, from West Africa	14
Corn Worm and grain Weevils, Remedies for	21
"Corvusiene" for protecting seeds	26
Elm-leaf curl and Woolly Aphis	24
Formalin as an Insecticide	18
Imported parasites of *Chloridea* in Sumatra	13
Phylloxera, Inverted galls produced by	18
Lead Arsenate as an insecticide	14
Leopard Moth in New York	3
Longicorn pest of Coffee in West Africa	22
Pepper Tree Caterpillar in the Transvaal	12
Pharynx of Dipterous larvae in relation to their food ...	20
Phytalus smithi attacking Sugar Cane in Mauritius	28
Sugar Cane Coccid in Costa Rica	20
Tetrastichus asparagi, Life History of	15
Tobacco, Mosaic Disease of	19
Tobacco pests in Sumatra	14
Vine Moths, Bionomics of *Clysia* and *Polychrosis*	5
Western Meadow Larks, Insects destroyed by	17
White Ants in Natal	12